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10/542,672	04/12/2006	Matthias Franz	10191/3945	1703

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EXAMINER	
BEKELE, MEKONEN T	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/542,672	Applicant(s) FRANZ ET AL.	
	Examiner MEKONEN BEKELE	Art Unit 2624	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09/30/2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *15-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 July 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 15-34 are pending in this application.

Priority

2 Acknowledgement is made of application's claim for foreign priority under 35 U.S.C. 119 (a)-(d) based on the Germany patent application No.10301898.0 filed on 01/17/2003.

Drawings

3. The drawings filed on 07/18/2005 are accepted for examination

Response to Argument

4. Applicants' response to the last Office Action, filed, on 07/21/2009 has been entered and made of record.

5. Applicants' amendment has required new grounds of rejection. New grounds rejection is therefore presented in the Office Action.

6. Applicant's arguments have been fully considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of the 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained thought the invention is not identically disclosed or described as set forth in section 102 of this title, if the difference between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 15-34 are rejected under 35 U.S.C 103 as being unpatentable over Szeliski, Richard (hereafter Szeliski) WO 0078038 A 1 published on December 21, 2000, in view of Lin; Qian (hereafter Li), US Patent No US 5812286 A published on Sep.22, 1998, further in view of Van de Poel et al(hereafter Van de Poel), US Patent No. 6061091, published on May 9, 2000.

As to claim 15, Szeliski teaches A method for adjusting a characteristic curve of exposure sensitivity **(Abstract, A system and method for manipulating a set of images of a static scene** captured **at different exposures to yield a composite image with improved uniformity in exposure and tone. The cumulative distribution function is then used to determine new pixel brightness levels for use in generating the composite image. The characteristic curve corresponds to the cumulative distribution function curve (see Fig.8A))** of at least one pixel of at least one image sensor **(Abstract: desired composite image can be produced by summing the pixel brightness levels across the multiple images captured by adjusting the up and down exposure sensors of the camera 55.** The image sensor **corresponds to the Kodak DCS-488 camera which has the exposure sensors**), in a motor vehicle, the characteristic curve being formed in segments of functions **(Abstract: histogram equalization involves creating a count of the number of pixels sets**

having the same summed brightness level. From this count, a cumulative distribution function is computed. Thus the cumulative distribution function is a piecewise continuous **(segmented) functions)** the method comprising:

imaging a scene (**Fig. 1A-1c**) using the at least one image sensor **(Abstract: multiple images with different brightness level can be captured by adjusting the up and down exposure sensors of the camera 55**);

adjusting the characteristic curve of the exposure sensitivity as a function of image signals (**page 13 lines 8-18; histogram equalization is a process for mapping pixel brightness values of an image to approximate a uniform distribution. Thus, distribution function is adjusted based on the image signal produced by the camera 26)** from at least a part of the scene registered (**Figs. 1A-IC: FIGS. 1A through IC are images depicting an office scene captured at different exposure settings)** by the at least one image sensor **(page 8 lines 8-18, a camera 55 capable of capturing a sequence of images 56 with different exposures by adjusting its the up and down the exposure sensors.** The image sensor **corresponds to the Kodak DCS-488 camera which has up and down exposure sensors (see page 1 line 25);**

However, it is noted that Szeliski does not specifically teach " a frequency of the gray values which is a number of pixels within an image that have the gray values based on a total number of pixels of at least a part of the histogram of image signals from the at least one image sensor of the at least one part of the registered scene, is approximately constant; and so that the gray value density, which is a sum of frequencies of the gray values in an interval of gray values in reference to the interval of at least a part of the histogram of image signals from the at least one image sensor of the at least one part of the registered scene~ is approximately constant.

However it is noted that Szeliski does not specifically teach "a frequency of the gray values which is a number of pixels within an image that have the gray values based on a total number of pixels of at least a part of the histogram of image signals from the at least one image sensor of the at least one part of the registered scene is approximately constant; the gray value density, which is a sum of frequencies of the gray values in an interval of gray values in reference to the interval of at least a part of the histogram of image signals from the at least one image sensor of the at least one part of the registered scene is approximately constant;" **although Szeliski strongly suggests the histogram equalization involves creating a count of the number of pixels sets having the same summed brightness level (page 3 lines 5-18 and lines 28-22). If the images are black and white, the pixel gray level could be used.** The frequency of the gray values **corresponds to the number of pixels sets having the same summed brightness level**, signals from the at least one image sensor **corresponds the signal generated by the stop up and down exposure sensors of the Kodak camera (page 1 lines 21-25),** the at least one part of the registered scene **(Fig. 1A-IC: FIGS. 1A through IC are images depicting an office scene captured at different exposure settings),** approximately constant **(page 1 lines 10- 11, the office scene captured at different exposure settings are static (constant) scene taken at different exposures).**

On the other hand the automatic color processing to correct hue shift and incorrect exposure of Lin teaches a frequency of the gray values which is a number of pixels within an image that have the gray values based on a total number of pixels of at least a part of the histogram of image signals from the at least one image sensor of the at least one part of the registered scene is approximately constant (**Figs. 3-5,8, Fig. 4 illustrates histogram of a scanned image, Fig. 5 illustrates a <u>cumulative gray level histogram</u> of the scanned image, and Fig.8 illustrates the histogram of the corrected image shown in FIG. 5. Further both the histogram graph**

(Fig. 4) and <u>the histogram of the corrected image graph</u> (Fig.8) are <u>plotted pixel count verse gray level.</u> Further Fig. 4 and Fig. 8 contain linear curves with very <u>gentle slope (almost zero slope</u>), and <u>clearly the pixel count is approximately constant where the slope of the histogram graph is gentle).</u>

It would have been obvious to one of ordinary skill in the art the time of invention was made to incorporate the automatic color processing to correct hue shift and incorrect exposure of Lin into the system and process for improving the uniformity of the exposure and tone of a digital image, because both Szeliski and Lin are directed to color correction of digital display media such as digital camera and scanner based on histogram of the acquired image(Line: Abstract, Szeliski :Abstract, page 3 lines 20-25).

It would have been obvious to one of ordinary skill in the art to incorporate the teaching of automatically correcting based on the histogram of the acquired image, because that would have allowed user of Szeliski to correct hue shift and incorrect exposure in scanner and digital camera, more efficiently(Lin col. I lines 52-55)

However, it is noted that both Szeliski and Lin do not specifically "teach the gray value density, which is a sum of frequencies of the gray values in an interval of gray values in reference to the interval of at least a part of the histogram of image signals from the at least one image sensor of the at least one part of the registered scene is approximately constant" although Szeliski suggests **the aim of a histogram equalization is that obtaining an equally-gray- value distribution density. In mathematic terms the density is the slope of the cumulative distribution function. Therefore, the derivative of the cumulative distribution function (CDF) gives the probability density function (PDF) or the gray value density function of the histogram. Thus the gray value density, the gray value- density**

corresponds to the slope of the cumulative distribution function (CDF). In addition the slope of CDF graph (see Fig. 8B) is approximately constant since the graph is approximately linear. Therefore, the gray value density is also approximately constant.

On the other hand the Detection of and correction for specular reflections in digital image acquisition of Van de Poel teaches the gray value density, which is a sum of frequencies of the gray values in an interval of gray values in reference to the interval of at least a part of the histogram of image signals from the at least one image sensor of the at least one part of the registered scene is approximately constant**(Figs. 2 and 3, col. 9 lines 36-60**, **Van de Poel specifically teaches a method of obtaining a cumulative frequency of density function Y=C(x) as a function of gray density level X (see Fig.3). The function Y=C(x) is obtained from the density frequency function Y=H(X) as shown in Fig. 2. The Y-axis of the cumulative frequency density function Y=C(X)represents <u>a cumulative frequency</u> (sum of frequencies) of occurrence, and the X-axis represents density level X, wherein positive density X levels represent <u>grey levels</u> up to black(col. 3 lines 50-55). Further, the density function Y=C(x) includes speculate reflections section where the cumulative frequency density (the sum of <u>frequencies between in the interval X1 and X2) is almost constant</u>).**

Notes: The cumulative frequency is <u>the running total of the frequencies</u>. On a graph, it can be represented by a cumulative frequency polygon, where straight lines join up the points, or a cumulative frequency curve (see for instant math revision net: Histograms and Cumulative Frequency at http://www.mathsrevision.net/alevel/pages.php?page=71)

It would have been obvious to one of ordinary skill in the art the time of invention was made to incorporate the detection of and correction for specular reflections in digital image acquisition of Van de Poel into the combined method of Szeliski and Lin, because all Szeliski, Lin and Van

de Poel are directed to histogram based digital image correction (Van de Poel: Abstract, Line: Abstract, Szeliski: Abstract, page 3 lines 20-25)

It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Image processing parameters for gradation correction of a digital image from a scene of Van de Poel into the combined method of Szeliski and Lin, because that would have allowed user of Szeliski to detect whether or not specular reflections are present in the scene, the image of which must be digitized, and to provide a method for computing a gradation curve(Abstract, col. 3 lines 30-40) suitable for correction of a digital image, in which specular reflections occurred, and give a suitable parameters for setting an optimal exposure time (Abstract)).

As to claim 16, Szeliski teaches the characteristic curve of the exposure sensitivity is adjusted as a function of image signals **(page 14 lines 16-17, a cumulative distribution function is computed using the summed brightness histogram where the histogram function is obtained from the signal generated by the camera 56. The characteristic curve of the exposure sensitivity corresponds to the cumulative distribution function)** from at least a part of the scene registered by the at least one image sensor (**Fig. 1A-IC, page 4 lines 23-24, 1A through IC are images depicting an office scene captured at different exposure settings.** The image sensor **corresponds to the Kodak DC-488 camera which has the up and down exposure sensors (see page 1 line 25)),** so that, when a gray value wedge having two segments with different gradients of the gray values is registered as the scene **(Fig. 1A-IC, page 4 lines 23-24, the office scene captured at different exposure settings have different gradients of the gray values)** the at least one image sensor generates an image nearly free of apparent contours **(Fig. 6, page 5 lines 8-1 1, FIG. 6 is a composite image produced from the bracketed images(set of images of a static scene captured at different exposures) of the office scene of FIGS. 1A through 1C that exhibits a more uniform exposure and tone**

than any of the bracket images. The image nearly free of apparent contours **corresponds to the composite image Fig. 6).**

As to claim 17, Szeliski teaches the characteristic curve of the exposure sensitivity (**Fig. 9A, page 5 lines 23, the graph of a cumulative distribution function)** is adjusted as a function of a determined optimal characteristic curve of the exposure sensitivity (**Figs. 9A -9C page 5 lines 27-29, a blended cumulative distribution function FIG. 9C is produced by blending the cumulative distribution function FIG. 9A with the straight line function FIG. 9B**. The determined optimal characteristic curve of the exposure sensitivity **corresponds to blended cumulative distribution function FIG. 9C),** including a determined characteristic curve of the exposure sensitivity which is optimal according to information theory **(Fig.1B, a straight line distribution function generates uniform distribution.** Thus, theoretical distribution function optimal according to information theory **corresponds to the straight line distribution function),** at least one of the optimal characteristic curve of the exposure sensitivity **(Fig.9c)** and the characteristic curve of the exposure sensitivity which is optimal according to information theory **(Fig, 9B)** being determined as a function of image signals **(Figs. 9A-9C, the Figs. 9A through 9C are plotted as a function of image signal generated by the camera56)** from the at least one image sensor **(page 5 line 31 and page 6 lines1-2, Fig. 18A is a composite image produced from the bracketed images of the office scene of FIGS. 1A through 1C using the up and down exposure sensors of the Kodak DCS camera (see page 1 line 25).**The image sensor corresponds to **the Kodak DCS which has up and down exposure sensors 56).**

As to claims 18, Szeliski teaches determining the optimal characteristic curve of the exposure sensitivity as a function of a histogram of the gray values (**page 13 lines 8-9, page 14 lines 16-17, histogram equalization is a process for mapping pixel brightness values of an image to approximate a uniform distribution. A cumulative distribution function is computed using the summed brightness histogram to determine the uniform distribution. Further if the images are black and white, then the standard pixel gray levels would preferably be used as the measure of pixel brightness (see page 16 lines 26-28)**. The characteristic curve of the exposure sensitivity **corresponds to the cumulative distribution function curve (Fig.9A)**, and the optimal characteristic curve of the exposure sensitivity **corresponds to Fig. 9C and which is obtained by blending the cumulative distribution function Fig. 9A with the straight line function Fig. 1B (page 15 lines 24-25)** of at least one image and/or of at least one image detail **(Fig. 1A-IC: FIGS. 1A through IC are images depicting an office scene captured at different exposure settings. Thus FIGS. 1A through IC have different image detail, and optimal (page 15 line 27-29))**

approximating the characteristic curve of the exposure sensitivity **(page 15 lines 24-25, blending the cumulative distribution function Fig. 9A with the straight line function Fig. 9B)** to the determined optimal characteristic curve of the exposure sensitivity **(page 16 lines 4-6 the blending process is carried out in order to determine the optimal cumulative distribution function (see Fig.9C) that represent the composite image (Fig.10B) having the best possible improvement in exposure and tone uniformity**. The optimal characteristic curve of the exposure sensitivity **corresponds to the blended cumulative distribution function Fig. 9C)**, including approximation of the characteristic curve of the exposure sensitivity to the determined optional characteristic curve of the exposure sensitivity through at least on numerical approximation method and/or at least one segmenting method **(Fig. 7B shows the steps of obtaining the optimal cumulative distribution function using numerical**

approximation that includes Normalization, Curve fitting, Histogram Equalization, Partial Equalization).

As to claim19, Szeliski teaches at least one of the gain **(Fig. 9A, the slope the cumulative distribution function graph that measure the uniformity of an image),** the offset, the integration time and at least one additional parameter **(page 14 lines 16-17, the characteristic pixel value which is pixel brightness values of an image)** for adjusting the characteristic curve of the exposure sensitivity **(page 14 lines 28-22, see also step 714, the pixel brightness values are adjuster in ordered to approximate the cumulative distribution function.** The characteristic curve of the exposure sensitivity **corresponds to the cumulative distribution function graph)** of the at least one pixel of the at least one image sensor **(Figs. 1A-1C the approximation is carried out by adjusting exposure and tone of the set of images (Figs. 1A-1C) captured at different exposure using the exposure sensors of the Kodak camera (see page 1 line 25)** is adjusted, the at least one additional parameter for adjusting the characteristic curve of the exposure sensitivity being at least one of (i) at least one parameter for adjusting the number of segments of the characteristic curve of the exposure sensitivity (**Fig. 7B, adjusting the summed e brightness values of values of an image),** (ii) at least one parameter for adjusting the position of the segments of the characteristic curve of the exposure sensitivity, (iii) at least one parameter for adjusting the size of the segments of the characteristic curve of the exposure sensitivity, and (iv) at least one parameter for adjusting the at least one function(**page 15 lines 18-28, blend the normalized cumulative distribution function with a straight line function.** The at least one function **corresponds to the linear function (Fig. 9B),** at least one parameter **corresponds to the pixel brightness values of an image that is used to approximate a uniform distribution of cumulative distribution function (page 13 lines 9-10).**

As to claim 20, Szeliski teaches at least one of the functions is a linear function **(Fig.9B).**

As to claim 21, Szeliski teaches the characteristic curve of the exposure sensitivity of the at least one pixel of the at least one image sensor is adjusted as a function of image signals **(page 13 lines 8-18, histogram equalization is a process for mapping pixel brightness values of an image to approximate a uniform distribution. Thus, distribution function is adjusted based on the image signal generated by camera 56)** from at least two image sensors, including at least one stereo camera **(page 1 lines 21- 25, FIGS. 1A through IC show three images of an office desk and window, taken at different exposures. Specifically, these images were captured with a Kodak DCS camera, by adjusting the exposure up and down by two "stops").**

Regarding claims 22-27, all claimed limitation are set forth and rejected as per discussion for claims 15-21.

As to claim 28, Szeliski teaches A computer program executable on a computer (**Fig. 2 page 7 lines 5-18, and page 23 claim 13),** comprising: a program code arrangement **(page 23 claim 13);**

Regarding the remaining section of claim 28, all claimed limitation are set forth and rejected as per discussion for claim1.

Regarding claims 29-34, all claimed limitation are set forth and rejected as per discussion for claims16-21.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact information

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Mekonen Bekele whose telephone number is 571-270-3915. The examiner can normally be reached on Monday -Friday from 8:00AM to 5:50 PM Eastern Time. If attempt to reach the examiner by telephone are unsuccessful, the examiner's supervisor AHMED SAMIR can be reached on (571)272-7413. The fax phone number for the organization where the application or proceeding is assigned is 571-237-8300. Information regarding the status of an application may be obtained from the patent Application Information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished application is available through Privet PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have question on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866.217-919 (tool-free)

/MEKONEN BEKELE/
Examiner, Art Unit 2624
December 29, 2009

/Brian Q Le/

Primary Examiner, Art Unit 2624